GMI: FUTURE DIRECTIONS???

“EVOLVING” ROLES/WORK OF GMI

- “Assessment” model incorporating “best” science, different approaches to evaluate uncertainty
  - High Speed Aircraft
  - IPCC
  - WMO
  - HTAP
  - We really have only considered different met. fields!
- “Test bed” for different approaches, algorithms, inputs – determine uncertainty.
  - Again, mostly (only?) tested meteorological fields
  - Analyzed versus forecast winds
  - Comparison to data to “grade” approaches (winds)
  - Comparison for aerosols, CCN (also different parameterizations)
- Developed a combined stratospheric-tropospheric model that performs quite (very) satisfactorily in comparison to measurements
- MAP 08???

GMI SUCESSES AND “NEEDS IMPROVEMENT”

- **SUCCESSES**
  - **Combo model**
    - **Good (great?) analysis tool for satellite measurements**
    - **Can help in improving satellite retrievals**
    - **Good tool for UT/LS**
    - **Chemistry being incorporated into chemistry-climate effort – paradigm for CTM “testing” of chemistry-climate components.**
    - **Contributor to international assessment efforts**
    - **ESMF compliant**
    - **Good aerosol stand-alone, aerosol/cloud interaction**
    - **Simulations available to community**
  - **Aerosol, cloud-chemistry**
    - **Uncertainties in loading, AOT, direct, indirect effect – met. fields, parameterizations, emissions…**

GMI SUCCESSES AND "NEEDS IMPROVEMENT" (II)

- **NEEDS IMPROVEMENT**
  - **We did not get much out of the simulations with different met. fields for tropospheric composition (old fields)**
  - **"Testbed" efforts limited, mostly met. fields; NOT COUPLED TO ASSESSMENT EFFORTS.**
  - **Incorporation of new algorithms is sometimes slow (aerosol/chemistry coupling!)**
  - **Only a few people actually run the model**
  - **Still not at the forefront in the community's perception – visibility.**
  - **Limited resources (and they may get smaller!!!????)**
  - **"Uncertainty" analysis not carried out within GMI structure (multi-model comparisons still reign supreme!).**
  - **Community involvement.**

GMI NEEDS TO CONNECT TO…

- **Atmospheric composition**
  - **More satellite / aircraft /ground based analysis**
  - **Capitalize on combined troposphere-stratosphere**
  - **Satellite retrieval algorithms?**
  - **Mission planning?**
  - **Other meteorological fields??? (Would need point persons to take on specific problem, ingesting met. fields, supplementing fields with something like MATCH)**
  - **Air quality? (Fine resolution satellites – adaptive grids?)**
- **Chemistry – climate**
  - **Testbed: streamline chemistry, test other processes: wet/dry deposition, convective transport, emissions, future composition.**
  - **Strong link between atmospheric measurement and chemistry climate models**
  - **Aerosol microphysics, aerosol/cloud interactions AEROCOM**
  - **Couple to other Earth system models:**
    - **Ocean emissions**
    - **Land processes (hindcast).**

GMI VS. CTMF (GEOS-5)

- **Does it make sense for GMI to "migrate" to a CTMF?**
- **When we finish incorporating the chemistry into GEOS-5, we would really have included:**
  - **Chemical mechanism and solver**
  - **FastJx**
  - **Emissions**
  - **Lightning parameterization**
  - **Wet/dry deposition consistent with GEOS-5 archived variables (maybe even improved)**
  - **In summary, everything in GMI except for advection and column transport**

GMI and GEOS 5: Advantages and Disadvantages of "Migration"

- **Advantages:**
  - **GMI is ESMF compliant**
  - **Leverage from developments/support in GEOS-5 (i.e., TPCORE)**
  - **A good chunk of GEOS-5 will contain GMI**
  - **Use both on-line and archived fields.**
  - **Community accessibility to GEOS-5?**
  - **Cheaper?**

- **Disadvantages**
  - **Software, diagnostics, analysis tools, etc. have been developed for GMI.**
  - **Using other met. fields may be difficult (GEOS-5 incorporates formulation from other analyses, i.e., convective algorithm… tested?**
  - **Learning curve**
  - **Still needs vetting/ownership by GMI/CTM community**

IGAC ATMOSPHERIC CHEMISTRY AND CLIMATE ACTIVITIES

- **Wet Deposition Workshop: Rodriguez agreed to be "point person", Jacob and Nenes helping, plus everybody else.**
- **Activity No. 1: Atmospheric Hindcast. Point person?**
- **Activity No. 2: What controls aerosol/gas distribution between 5 km and tropopause. Point person: Penner? Rodriguez?**
- **Activity No. 3: Better representation of clouds, aerosols, and chemical interactions. Point person: Nenes?**
- **Activity No. 4: Sensitivities and uncertainties in future scenarios for climate models (in preparation for next IPCC) Point person: Prather?**

GMI ACTIVITIES: KEEP, DO MORE, DO LESS, START, STOP: ASSESSMENT

	KEEP	DO MORE	DO LESS	START	STOP	SCIENCE?
HTAP	?					NEEDED EXPLORE NON-LIN.
IPCC		ON-LINE CHEMISTRY		"CONNECT" TO OTHER MODELS		EVALUATE FUTURE INCORPORATE?
WMO		SAME				NEEDED
AIRCRAFT						NEEDED

GMI ACTIVITIES: KEEP, DO MORE, DO LESS, START, STOP: TEST BED ACTIVITIES

	KEEP	DO MORE	DO LESS	START	STOP	SCIENCE?
MET. FIELDS (BESIDES GEOS)		x				ANALYZED TRANSPORT CORE?
CHEMICAL MECH.		X				MORE HC PHOTLYSIS/CLOUDS SPATIAL REDUCT.
WET/DRY DEPOSITION	WORK SHOP					
EMISSIONS	x					UPDATE AS AVAILABLE – TRNEDS
MODEL						

GMI ACTIVITIES: OTHER / NEW?

	KEEP	DO MORE	DO LESS	START	STOP	SCIENCE?
SATELLITE DATA ANALYSIS		x				
SATELLITE RETRIEVAL						
MISSION PLANNING						
CHEMISTRY/ CLIMATE	x					
AIR QUALITY?			x			LEAVE TO RES. MODELS

GMI ACTIVITIES: AEROSOLS, CLOUDS

	KEEP	DO MORE	DO LESS	START	STOP	SCIENCE?
AEROSOL COMP.		x				
MICRO-PHYSICS		x				
CLOUDS		x				CLO\UD FRATION
AEROCOM					x	

GMI ACTIVITIES: MISCELLANEOUS

	KEEP	DO MORE	DO LESS	START	STOP	SCIENCE?
IGAC #1 HINDCAST		x				
IGAC #2 UPPER TROP.		x				
IGAC #3 AEROSOLS, CLOUDS	x					
IGAC #4 FUTURE SCENARIOS FOR CLIMATE		x				
GEOS-5 MIGRATION	x					

Steering Committee

- **Meteorological field processing – Do GEOS-4? Hindcast. How long?**
  - **How long will it take? Did Bob concatenate?**
  - **Hindcast a high priority.**
  - **MAP 08 initiative – data sets, model calculations.**
  - **Includes aerosols.**
  - **EC fields?**
  - **MAP also to use other fields.**
  - **ERA 40 redone?**
- **Coupled chemistry-aerosols**
  - **Start with COMBO?**
  - **Simplify the chemistry / use GCM for stratosphere use forcings in bc, sst.; linoz. Fast COMBO.**
- **Deliver pieces to the Earth System Model : Build and test.**
- **Couplng of chemistry/dynamics / clouds**
- **Incorporate cloud/aerosol into standard GMI code – Get somebody from GIT.**

- **Ice coupling.**
- **Aerosol cloud coupling into chemistry.**
- **Feedback of clouds, ice clouds into photolysis.**
- **Merge activity no. 2 into hindcast? Validation, data sets.**
  - **Aircraft is part of this.**
- **Chemical data assimilation?**
- **Inversion?**